WHAT IS CLAIMED IS:

1. A rotational torque detection mechanism comprising:

a rotational shaft rotatably supported whose first end portion reaches outside the mechanism;

a magnetostrictive membrane disposed on a surface of the rotational shaft and the membrane varying magnetic permeability thereof according to an amount and direction of rotational torque acting on the rotational shaft;

an excitation circuit which is disposed to confront the rotational shaft so as to excite the magnetostrictive membrane; and

a detection circuit which is disposed to confront the rotational shaft so as to electrically detect a change of the magnetic permeability of the magnetostrictive membrane,

wherein the first end portion is adapted to be a free end and a second end portion of the rotational shaft is rotatably supported.

2. A rotational torque detection mechanism according to claim1 further comprising an elastic member which is slidably disposed around the first end portion.

3. A rotational torque detection mechanism according to claim1 further comprising a bearing which is disposed around the first end portion with a predetermined gap distance.

4. A rotational torque detection mechanism according to claim 1 wherein a thickness of the magnetostrictive membrane is adapted to be less than or

equal to 30 micron meters.

5. A rotational torque detection mechanism according to claim1 wherein Rockwell hardness of the rotational shaft is adapted to fall in a range between equal to or greater than 40 and less than or equal to 65.

6. An electric power steering apparatus in which the rotational torque detection mechanism according to claim 1 is installed, wherein the apparatus provides assist torque according to an output signal of the mechanism.

7. An electric power steering apparatus according to claim 6 further comprising a shock absorber which relaxes impact force acting on the rotational torque detection mechanism.

8. A method for manufacturing a rotational torque detection mechanism which comprises a rotational shaft, a magnetostrictive membrane disposed on a surface of the rotational shaft, an excitation circuit for exciting the magnetostrictive membrane, and a detection circuit for electrically detecting a change of magnetic permeability of the magnetostrictive membrane, the method comprising the steps of:

applying heat treatment to the rotational shaft so that Rockwell hardness thereof is adapted to fall in a range between equal to or greater than 40 and less than or equal to 65;

attaching the magnetostrictive membrane to the rotational shaft after the heat treatment; and

imposing anisotropy on the magnetostrictive membrane.